

Claims

1. A fibre-shaping peptide comprising a hub and a plurality of peptide monomer units each being attached at one end thereof to the hub, wherein the free ends of at least
5 2 peptide monomer units are N-termini or C-termini, and each of the at least 2 peptide monomer units is capable of interacting with a sub-unit of a self-assembling peptide to form an overlapping staggered structure.
2. The fibre-shaping peptide according to claim 1, wherein the hub is one or more
10 amino acids residue having a plurality of derivatisable sites to which the peptide monomer units can be attached.
3. The fibre-shaping peptide according to claim 2, wherein the hub is lysine or
15 glutamic acid.
4. The fibre-shaping peptide according to any one of the preceding claims, which comprises 2 to 4 peptide monomer units.
5. The fibre-shaping peptide according to any one of claims 1 to 3, which
20 comprises 2 peptide monomer units.
6. The fibre-shaping peptide according to any one of the preceding claims, wherein each peptide monomer unit is attached to the hub via a flexible linker.
- 25 7. The fibre-shaping peptide according to claim 6, wherein the flexible linker is a peptide linker comprises amino acids selected from the group consisting of glycine, alanine, serine and β -alanine.
8. The fibre-shaping peptide according to claim 6, wherein the flexible linker is a
30 poly- β -alanine peptide.

9. The fibre-shaping peptide according to any one of the preceding claims which additionally comprises one or more functional molecules attached to the hub.

10. The fibre-shaping peptide according to claim 9, wherein the functional molecule is an antibody molecule, a receptor, a ligand, an enzyme, an antigen, a label, a metal ion or a nucleic acid molecule.

11. The fibre-shaping peptide according to claim 9 or claim 10, wherein the functional molecule is attached to the hub via a flexible linker.

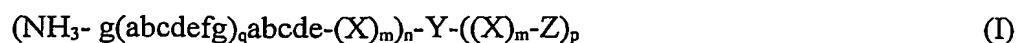
12. The fibre-shaping peptide according to claim 11, wherein the flexible linker is a peptide linker comprises amino acids selected from the group consisting of glycine, alanine, serine and β -alanine.

13. The fibre-shaping peptide according to claim 11, wherein the flexible linker is a poly- β -alanine peptide.

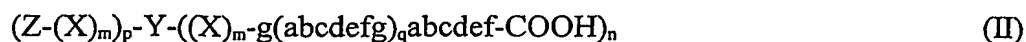
14. The fibre-shaping peptide according to any one of the preceding claims, wherein the at least 2 peptide monomer units comprise a heptad repeat motif and/or a hendecad repeat motif.

15. The fibre-shaping peptide according to claim 14, which is capable of forming a staggered parallel coiled coil structure with a self-assembling peptide which comprises a heptad repeat motif and/or a hendecad repeat motif.

16. The fibre-shaping peptide according to claim 1 having the formula:



or



wherein abcdefg is a heptad repeat motif;

X is a flexible linker;

Y is a hub;

Z is a functional molecule;

q is 2 to 15;

5 m is 0 or 1;

n is 2 to 4; and

p is 1 to 4.

10 17. The fibre-shaping peptide according to claim 16, wherein X is a poly- β -alanine peptide.

18. The fibre-shaping peptide according to claim 16 or claim 17, wherein Y is lysine in formula (I).

15 19. The fibre-shaping peptide according to claim 16 or claim 17, wherein Y is glutamic acid in formula (II).

20 20. The fibre-shaping peptide according to any one of claims 16 to 19, wherein q is 1 to 5.

21. The fibre-shaping peptide according to any one of claims 16 to 20, wherein n is 2.

25 22. A fibre-shaping peptide having the sequence:



23. A fibre-shaping peptide having the sequence:



24. A protein structure comprising a fibre-shaping peptide according to any one of the preceding claims.

25. A protein structure comprising a plurality of fibre-shaping peptides according to any one of claims 1 to 23 and a plurality of self-assembling peptides, wherein the first and second peptide monomers self-assemble to form a non-linear protein structure.

26. The protein structure according to claim 23, wherein the ratio of fibre-shaping peptides: first self-assembling peptides: second self-assembling peptides is from about 1×10^{-6} :1:1 to 10:1:1.

27. The protein structure according to claim 25, which comprises kinked and waved protein fibres.

28. The protein structure according to claim 25, which comprises split and branched protein fibres.

29. The protein structure according to claim 25, which is a matrix, a grid, a scaffold, a filter or a network.

30. The protein structure according to any one of claims 25 to 29, wherein the plurality of self-assembling peptides comprises peptides having the sequence $\text{NH}_3\text{-KIAALKQKIASLKQEIDALEYENDALEQ-COOH}$ and peptides having the sequence $\text{NH}_3\text{-IRRLKQKNARLKQEIAALEYEIAALEQ-COOH}$.

31. A method of producing a protein structure according to any one of claims 25 to 30, comprising mixing a plurality of fibre-shaping peptides according to any one of claims 1 to 23 and a plurality of self-assembling peptides under conditions so that the peptides associate to form a protein structure.

32. A kit for producing a protein structure according to any one of claims 25 to 30, wherein the kit comprises a plurality of fibre-shaping peptides according to any one of

claims 1 to 23 and a plurality of self-assembling peptides which, wherein the first and second peptide monomers can associate to form a protein structure.

33. Use of the protein structure according to any one of claims 24 to 30 in the
5 purification of biological fluids.
34. Use of the protein structure according to any one of claims 24 to 30 for assembling cells for cell and tissue engineering.
- 10 35. Use of the protein structure according to any one of claims 24 to 30 in surface engineering procedures.
36. A self-assembling peptide having the sequence
NH₃-KIRRLKQKNARLKQEIAALEYEIAALEQ-COOH (SAF-p2a).